AMENDMENT

LISTING OF CLAIMS:

The following listing supplants all prior listings of the claims.

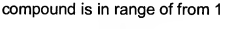
1. - 11. (Canceled)

12. (Original) An organic-inorganic hybrid proton-conductive material containing a organic-inorganic hybrid material and a proton source which imparts proton conductivity into the organic-inorganic hybrid material, and wherein the organic-inorganic hybrid material is produced by crosslinking a precursor that is an organosilicon compound having a mesogen group.

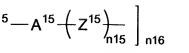
13. (Original) The organic-inorganic hybrid proton-conductive material of claim 12, wherein the organic-inorganic hybrid material is produced by three-dimensionally crosslinking the precursor.

14. (Original) The organic-inorganic hybrid proton-conductive material of claim 12, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

15. (Currently Amended) The organic-inorganic hybrid proton-conductive material of claim 12, the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



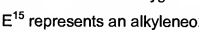
(1-4)



(1-5)

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

16. (Original) The organic-inorganic hybrid proton-conductive material of claim 12, the organic-inorganic hybrid material is produced by polymerizing a compound of the following formula (1-1):

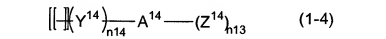


(1-1)

wherein A^1 represents an organic atomic group that contains a mesogen group and an alkylene group having at least 4 carbon atoms; R^{11} represents an alkyl group, an aryl group or a heterocyclic group; X^1 represents a halogen atom or OR^{14}; R^{14} represents a hydrogen atom, an alkyl group, an aryl group or a silyl group; m11 indicates an integer of from 0 to 2; n11 indicates an integer of from 1 to 10; when m11 or 3-m11 is 2 or more, then R^{11}'s or X^1's may be the same or different.

17. (Original) The organic-inorganic hybrid proton-conductive material of claim 16, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

18. (Currently Amended) The organic-inorganic hybrid proton-conductive material of claim 16, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



(1-4)

(1-5)

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

19. (Currently Amended) The organic-inorganic hybrid proton-conductive material of claim ~~11~~ 12, wherein the organic-inorganic hybrid material is produced by three-dimensionally crosslinking a precursor that is an organosilicon compound that has an alkoxysilyl group, a mesogen group and a substituent group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization.

20. (Original) The organic-inorganic hybrid proton-conductive material of claim 19, wherein the organic-inorganic hybrid material is produced through sol-gel reaction of a precursor that is an organosilicon compound of the following formula (2-1) to form an Si-O-Si bond, combined with polymerization of the substituent in the organosilicon compound to form a carbon-carbon bond or a carbon-oxygen bond:

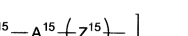
$$(R^{23})_{n22}—A^2\left[Si(OR^{21})_{3-m21}\ (R^{22})_{m21}\right]_{n21} \qquad (2\text{-}1)$$

wherein A^2 represents an organic atomic group containing a mesogen group; R^{21} represents an alkyl group; R^{22} represents an alkyl group, an aryl group or a heterocyclic group; R^{23} represents a substituent group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; m21 indicates an integer of from 0 to 2; n21 indicates an integer of from 1 to 10; n22 indicates an integer of from 1 to 5; when 3-m21 or m21 is 2 or more, then R^{21}'s or R^{22}'s may be the same or different; when n22 is 2 or more, then R^{23}'s may be the same or different.

21. (Original) The organic-inorganic hybrid proton-conductive material of claim 20, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

22. (Currently Amended) The organic-inorganic hybrid proton-conductive material of claim 20, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:

$$\left[\left(Y^{14}\right)_{n14}—A^{14}—(Z^{14})_{n13}\right. \qquad (1\text{-}4)$$



(1-5)

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

23. (Original) The organic-inorganic hybrid proton-conductive material of claim 12, wherein the organic-inorganic hybrid material is produced through crosslinking polymerization of a precursor that is a polymer having, in the side branches thereof, an atomic group that contains an alkoxysilyl group, a mesogen group and an alkylene group.

24. (Original) The organic-inorganic hybrid proton-conductive material of claim 23, wherein the organic-inorganic hybrid material is produced by a precursor is a polymer having a repeating unit of the following formula (3-1):

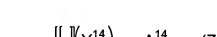
(3-1)

wherein A^3 represents an organic atomic group that contains a mesogen group and an alkylene group; R^{31} represents an alkyl group; R^{32} represents an alkyl group, an aryl group or a heterocyclic group; E^3 represents an alkyleneoxy group, an alkylene group or

a siloxy group; L^3 represents a linking group; m31 indicates an integer of from 0 to 2; n31 indicates an integer of from 1 to 10; n32 indicates an integer of from 1 to 5; when 3-m31 or m31 is 2 or more, then R^{31}'s or R^{32}'s may be the same or different.

25. (Original) The organic-inorganic hybrid proton-conductive material of claim 24, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

26. (Currently Amended) The organic-inorganic hybrid proton-conductive material of claim 24, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



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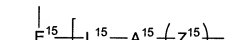


(1-5)

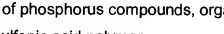
wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

27. (Original) A fuel cell that comprises an organic-inorganic hybrid proton-conductive material, wherein the organic-inorganic hybrid proton-conductive material containing a organic-inorganic hybrid material and a proton source which imparts proton conductivity into the organic-inorganic hybrid material, and wherein the organic-inorganic hybrid material is produced by crosslinking a precursor that is an organosilicon compound having a mesogen group.

28. (Original) The fuel cell of claim 27, wherein the organic-inorganic hybrid material is produced by three-dimensionally crosslinking the precursor.

29. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 27, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

30. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 27, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



(1-4)

(1-5)

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms;

Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

31. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 27, wherein the organic-inorganic hybrid material is produced by polymerizing a compound of the following formula (1-1):

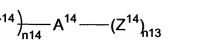
$$A^1\left[-Si(X^1)_{3-m11}(R^{11})_{m11}\right]_{n11} \qquad (1\text{-}1)$$

wherein A^1 represents an organic atomic group that contains a mesogen group and an alkylene group having at least 4 carbon atoms; R^{11} represents an alkyl group, an aryl group or a heterocyclic group; X^1 represents a halogen atom or OR^{14}; R^{14} represents a hydrogen atom, an alkyl group, an aryl group or a silyl group; m11 indicates an integer of from 0 to 2; n11 indicates an integer of from 1 to 10; when m11 or 3-m11 is 2 or more, then R^{11}'s or X^1's may be the same or different.

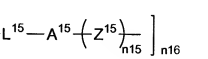
32. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 31, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

33. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 31, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein

the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



(1-4)



(1-5)

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

34. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 27, wherein the organic-inorganic hybrid material is produced by three-dimensionally crosslinking a precursor that is an organosilicon compound that has an alkoxysilyl group, a mesogen group and a substituent group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization.

35. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 34, wherein the organic-inorganic hybrid material is produced through sol-gel reaction of a precursor that is an organosilicon compound of the following formula (2-1) to form an Si-O-Si bond, combined with polymerization of the

substituent in the organosilicon compound to form a carbon-carbon bond or a carbon-oxygen bond:

$$(R^{23})_{n22}—A^2\left[Si(OR^{21})_{3-m21}\ (R^{22})_{m21}\right]_{n21} \qquad (2\text{-}1)$$

wherein A^2 represents an organic atomic group containing a mesogen group; R^{21} represents an alkyl group; R^{22} represents an alkyl group, an aryl group or a heterocyclic group; R^{23} represents a substituent group capable of forming a carbon-carbon bond or a carbon-oxygen bond through polymerization; m21 indicates an integer of from 0 to 2; n21 indicates an integer of from 1 to 10; n22 indicates an integer of from 1 to 5; when 3-m21 or m21 is 2 or more, then R^{21}'s or R^{22}'s may be the same or different; when n22 is 2 or more, then R^{23}'s may be the same or different.

36. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 35, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

37. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 35, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formulae (1-4) and (1-5), and wherein the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:

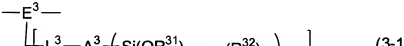
$$\left[\left[-\right]\left(Y^{14}\right)_{n14}A^{14}—(Z^{14})_{n13}\right. \qquad (1\text{-}4)$$

$$E^{15}\left[L^{15}—A^{15}\left(Z^{15}\right)_{n15}\right]_{n16} \qquad (1\text{-}5)$$

wherein, in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.

38. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 27, wherein the organic-inorganic hybrid material is produced through crosslinking polymerization of a precursor that is a polymer having, in the side branches thereof, an atomic group that contains an alkoxysilyl group, a mesogen group and an alkylene group.

39. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 38, wherein the organic-inorganic hybrid material is produced by a precursor is a polymer having a repeating unit of the following formula (3-1):

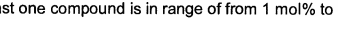


(3-1)

wherein A^3 represents an organic atomic group that contains a mesogen group and an alkylene group; R^{31} represents an alkyl group; R^{32} represents an alkyl group, an aryl group or a heterocyclic group; E^3 represents an alkyleneoxy group, an alkylene group or a siloxy group; L^3 represents a linking group; m31 indicates an integer of from 0 to 2; n31 indicates an integer of from 1 to 10; n32 indicates an integer of from 1 to 5; when 3-m31 or m31 is 2 or more, then R^{31}'s or R^{32}'s may be the same or different.

40. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 39, wherein the proton source is at least one selected from the group consisting of phosphorus compounds, organic sulfonic acids and perfluorocarbonsulfonic acid polymers.

41. (Currently Amended) The ~~organic-inorganic hybrid proton-conductive material~~ fuel cell of claim 39, wherein the organic-inorganic hybrid material further comprises at least one compound of the following formula (1-4) and (1-5), and the amount of the at least one compound is in range of from 1 mol% to 50 mol% relative to the precusor:



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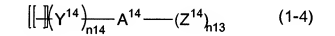

(1-5)

wherein in formulae (1-4) and (1-5), A^{14} and A^{15} each represent an organic atomic group that contains a mesogen and an alkylene group having at least 4 carbon atoms; Z^{14} and Z^{15} each represent a substituent not changing in sol-gel reaction, or a hydrogen atom; n13 and n15 each indicate an integer of from 1 to 8; n14 indicates an integer of from 0 to 4; n16 indicate an integer of from 1 to 5; Y^{14} represents a polymerizing group that may form a carbon-carbon bond or a carbon-oxygen bond through polymerization; L^{15} represents a linking group; E^{15} represents an alkyleneoxy group, an alkylene group or a siloxy group; when n13 or n15 is 2 or more, then Z^{14}'s or Z^{15}'s may be the same or different.